

Memorandum

To: Dr. Joshua Lederberg
From: Lynda Weisberg

January 29, 1971

Re: The existence of fads and fashions in science

The literature on the phenomenon of fads and fashions in science is sparse. Most of the work has been the stepchild of research in cultural history, social psychology and the history of science. These studies have focused mainly on a much larger issue: the gradual evolution of ideas and the intellectual revolutions which have occurred in each epoch. A large literature exists on this fascinating topic (just to mention the most famous -- Kuhn's, The Structure of Scientific Revolutions), and the relationship of our topic to this grander view will be sketchily reviewed here.

Imprecise definitions and a lack of consensus on the description of "fads and fashions" have interfered with a clear conceptualization of the process. Bernard Barber rightly points out that the overgeneralization of the term has led to a tendency to exaggeration and negativism. He charges that labeling as "fashionable" a field which is rapidly changing begs the analysis and cheapens the quality of dissent. In addition, Barber finds a tendency to exaggerate the prevalence of fashion in science, and he finds that some scientists use the label like "an ideological stick with which to beat some field of research in which there has been a recent increase and which the user does not like." ¹

In trying to analyze the various themes and definitions, Barber finds that an essential element is "changefulness." Since the rate of scientific growth has been increasing (at least until the past few years of drought in funding) change is inevitable. He ascribes positive and negative aspects of change. Sources of change may be new ideas, new recruits and personnel, or new access through improved data communications. Of course, additional funding in a specialization will product change. And historically, new specialties within a university have grown when a chair or a professorship has been awarded to a worker in the field. ² These avenues of change can create what Barber calls "functional" or "dysfunctional" effects. The "dysfunctional" effects include a misallocation of funds and talent into an area which is important only because it is new. According to Barber, a dysfunction would occur "when there is a failure to maintain the norms of originality and autonomy, or at least not to achieve them in the fullest measure." ³

Barber's analysis might be criticized for several flaws. First, he does not offer a definition or measure of what the "norms of originality and autonomy" are or ought to be. And related to this, he does not construct a method for measuring the extent of the "functional" or "dysfunctional" effects. Third, he does not substantiate his theoretical analysis with examples. He leaves us dissatisfied.

Siggia takes a different point of departure. ⁴ He attacks the underlying motivations for shifts in research. Some workers, he argues, are "irrational" or even "counter-productive." His premise is that the enormous increase in technological equipment and in methodologies attracts scientists by the novelty and

prestige of ownership involved. The temporary interest and/or utility of new techniques makes them "fashionable" and -- synonymously -- wasteful. He cites an example:⁵

"Some of the current specific fashion trends in (chemical) analysis are as follows:

"1. Automatic Carbon, Hydrogen, Nitrogen Analyzers. It was predicted that these analyzers, if successful, would be in demand. There was no need for such analyzers; CHN analysis could be accomplished by existing methods and the time involved ranged up to 30 minutes, which was not excessive. However, it was felt that the automated approach would have sales appeal on the basis of time saved and no need for highly trained personnel. These advantages plus the general availability of money for instruments and the mood of the public to buy the "new thing" made for an attractive business venture. Although several instrument companies have entered the automatic C, H, and N field, some have already dropped out with devices that did not compete with more successful equipment."

Siggia argues that in his field, analytical chemistry, the effects of fashion trends are counter-productive: "overinstrumentation, specialization and as a reaction -- anti-analytical specialization." Further, he feels that the superfluity of technology can overemphasize the need for specialists.

The most distressing charge is that "baubles" "frills" and "spangled" devices cost the scientist much more money than simpler tools. "In mass spectrometry, many people buy double-focusing instruments at \$130,000 when \$30,000 to \$40,000 instruments will handle most of the jobs they need to do."⁶ And finally, "the chemist today is motivated not by what he needs, but by the money he has to spend, the drive for instrumental status and a desire for a show-place laboratory."⁷

Improper motivations in science no doubt exist. Research in social psychology has certainly shown that status in the eyes of one's peers is an especially important goal to a scientist. Scientific elites may be responsible for combining work in the laboratory with "consulting" work for firms which build machinery -- thereby adding an unscientific motivation in the stew.

Despite his strong beliefs, Siggia does not offer a formidable portrait of a scientist working under these false assumptions; nor does he describe the conditions under which improper decisions are made. His views, however, should be included in a catalog of this kind.

Rene Dubos has made some harsh comments on the prevalence of fashions in science. He believes that many areas of research are not explored thoroughly before they are abandoned for new fields. Many scientists, he believes, have distorted interpretation of how scientific discoveries are made. Writing of the serendipitous scientific discovery he says, "Oddly enough, this simple concept has been given so much importance and dignity during the past few decades that it has become the dominant scientific philosophy."⁸ Presumably, their assumptions lead them into areas where much can be learned, because the areas of research are well-defined.

"If one were to judge from much recent writing, even by some scientists, the justification for doing research on almost any subject is the statistical chance of achieving by accident useful and practical results. This cult of serendipity is based on an erroneous interpretation of the history of science, and furthermore amounts to an abdication of intellectual and ethical responsibility. Serendipity is the equivalent of Stephen Vincent Benet's line, 'We don't know where we're going, but we're on our way.'" ⁹

So far, then, we have three rather different ideas about what fashion is and how it affects scientific progress: the changefulness of science; improper prestige-seeking; and finally, impatience with the pace of learning and a desire to work in clearly defined areas.

Diana Crane adds another dimension to the analysis. Her paper grew out of work on her dissertation on "the environment of discovery." Reviewing the literature on fashion in general she concluded that three themes were prevalent: 1) that fashion occurs only in trivial areas; 2) that fashion acceptance is irrational and 3) that the elite plays an important role in setting fashion. She then asked whether events occur in science which may be compared to fashionable trends in music, clothing, etc.

She writes, " Scientists generally consider fashion, which they define as the selection of problems on the basis on non-scientific criteria, as a form of deviance. Fashion is viewed as having a detrimental effect on the development of science, since manpower is distracted from significant research areas to less important ones." ¹⁰

With this description in mind, then, following a fashion becomes an example of improper motivation. Research problems are selected for the prestige value they bring, rather than for the scientific merit they may have. Crane believes this is an unproductive stance to take because it does not allow an observer to agree on whether a particular phenomenon is an example of fashion. (For instance, there may be many areas of research where the field is both fashionable and objectively important -- would this example be "deviant behavior" of "functional fashion"?)

Crane cites an unpublished paper by Blumer in which he postulates that fashion operates only in an area in which "people are willing to discard old forms and to adopt new forms. There must be different models competing for adoption and no means for establishing the superiority of any one of them by clear, practical test." ¹¹

Those influences which ultimately operate to encourage a fashion may include the attitude of the elite, or the promotion of a fashion by a group which stands to gain by that fashion. A further point is that "not all fashions can be successfully promoted at a particular time, but only those which are in keeping with the Zeitgeist of the period." The "sense of appropriateness" has an effect on the choice.

Blumer's argument lends support to the idea that fashion may, indeed, occur in non-trivial areas -- such as in science. Having reached this decision Crane makes the creative search for what is "normal" growth in science. To quote:

"The model of growth which is often attributed to fashion in science is that of a sudden spurt of interest followed by an equally rapid decline. However, scientific knowledge is cumulative and spurts of growth of this type are exceedingly rare. They represent aberrations rather than natural processes in science. The normal process of growth in a scientific field is the logistic growth curve of S curve."¹²

If scientists move into a field more rapidly than the curve would deem normal, that is an indication of popularity. After this spurt of popularity, a slower, more linear growth should take place at a relatively constant level, until the most challenging problems have been worked out.

The conditions producing rapid exponential growth are relatively easily ascertained. An important one is the number of publications written on a subject. Another is the effect of the scientific elite which enters into a field and to what degree they exert an influence. Third, the amount of funds available to a new field of interest will bear an important role. This last one plays an important part in supporting new ideas at the start, to learn whether they will become useful or attractive.

Crane points out that the very organization of science precludes a massive swing into a new field (the growing interest in the environment by scientists in all fields may be a departure from this model). Scientific training allows a worker in one small field to be familiar with ideas in two or three related fields. Therefore, when an idea is launched in one area, it may spread rapidly because of the number of workers who are able to grasp the idea and to move quickly into an adjacent field of study.

"A pool of scientists somewhat on the periphery can be rapidly assimilated, thus creating one of the conditions for both a high rate of exponential growth and fashion -- a large following."¹³

Whether or not the field enters a period of ^{continued, large} growth depends on the communication among scientists and the number of original workers who are committed to the field. Depending on whether the innovation is technical or theoretical, there may be greater acceptance of it (perhaps Siggia's remarks were addressed to the technological innovations which evidently attract followers more quickly than theoretical hypotheses).

Allegations of fashion seem to depend on the number of scientists who become visible -- either because there are large numbers of them or because of their exciting productions. Second, the degree of theoretical development -- which can be evaluated objectively -- may support quick growth. If there is only weak development, justification for working in the field may be missing. On the other hand, when strong theoretical foundations exist "fashion", i.e. "deviant motivational behavior" will not be involved.

The contrary situation is one in which theoretical development is high, but the number of workers is low. Perhaps Dubos' complaint grew from his work in a field which, while theoretically important, simply did not compete well with other disciplines. It is likely that his field of organismic biology had been developed to the point that only very difficult ideas remained to be probed. This may be why he complained that young scientists preferred to work in areas where the theories were "neat". (Kuhn calls this stage of a field "post-normal" science.)

"In situations where strong theoretical justification for the selection of research problems does not exist, one also finds many scientists working on certain problems and relatively few scientists working on others. The first possibility represents fashions, but the second does not. The latter can best be described as a diffusion process where ideas move slowly through a group, the process of adoption being a gradual rather than a rapid one due to the structure of the communication network... In both processes, social validation and influence explain the differential acceptance of various possibilities for chance." 14

Crane, then, feels that only very special instances deserve to be labelled as "fashion" -- if by that term, a deviance from a rational process is indicated. Her model is very complete and is based on an evident respect for the normal process of growth in science and the sound motivations of workers within scientific fields of endeavor.

Footnotes

1. Barber, Bernard. "The functions and dysfunctions of 'fashion' in science: a case for the study of social change." *Mens en Maatschappij* 43 (6), Nov/Dec. 1968. p. 502.
2. Kuhn, Thomas. The Structure of Scientific Revolutions.
3. Barber. p. 507.
4. Siggia, Sidney. "Fads and fashions in analytical chemistry." *Research/Development*. January, 1969. p. 22-27.
5. Siggia. p. 24.
6. Siggia. p. 27.
7. Siggia. p. 27.
8. Dubos, Rene. "We are slaves to fashion in research!" *Scientific Research*. January, 1967. p. 37.
9. Dubos. p. 37.
10. Crane, Diane. "Fashion in science: does it exist?" *Social Problems*. 16 (4): Spring, 1969. p. 435.
11. Blumer, Herbert. "The Nature and Role of Fashion" paper presented to the American Sociological Association, MONTreal, 1964. unpublished
12. Crane. p. 435.
13. Crane. p. 437.
14. Crane. p. 440.